

CoolMOS™ Power Transistor

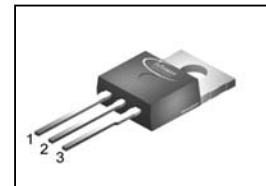
Product Summary

Features

- Worldwide best $R_{ds(on)}$ in TO220
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Qualified according to JEDEC¹⁾ for target applications
- Pb-free lead plating; RoHS compliant

$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	0.099	Ω
$Q_{g,typ}$	60	nC

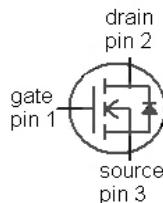
PG-T0220



CoolMOS CP is specially designed for:

- Hard switching SMPS topologies for Server and Telecon

Type	Package	Ordering Code	Marking
IPP60R099CP	PG-T0220	SP000057021	6R099


 Maximum ratings, at $T_j=25$ °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25$ °C	31	A
		$T_C=100$ °C	19	
Pulsed drain current ²⁾	$I_{D,pulse}$	$T_C=25$ °C	93	
Avalanche energy, single pulse	E_{AS}	$I_D=11$ A, $V_{DD}=50$ V	800	mJ
Avalanche energy, repetitive t_{AR} ^{2),3)}	E_{AR}	$I_D=11$ A, $V_{DD}=50$ V	1.2	
Avalanche current, repetitive t_{AR} ^{2),3)}	I_{AR}		11	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0...480$ V	50	V/ns
Gate source voltage	V_{GS}	static	± 20	V
		AC ($f>1$ Hz)	± 30	
Power dissipation	P_{tot}	$T_C=25$ °C	255	W
Operating and storage temperature	T_j, T_{stg}		-55 ... 150	°C
Mounting torque		M3 and M3.5 screws	60	Ncm

Maximum ratings, at $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value		Unit
Continuous diode forward current	I_S	$T_c=25\text{ }^\circ\text{C}$	18		A
Diode pulse current ²⁾	$I_{S,pulse}$		93		
Reverse diode dv/dt ⁴⁾	dv/dt			15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	0.5	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	T_{sold}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

Electrical characteristics, at $T_j=25\text{ }^\circ\text{C}$, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=1.2\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=600\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ }^\circ\text{C}$	-	-	5	μA
		$V_{DS}=600\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=150\text{ }^\circ\text{C}$	-	50	-	
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$, $I_D=18\text{ A}$, $T_j=25\text{ }^\circ\text{C}$	-	0.09	0.099	Ω
		$V_{GS}=10\text{ V}$, $I_D=18\text{ A}$, $T_j=150\text{ }^\circ\text{C}$	-	0.24	-	
Gate resistance	R_G	$f=1\text{ MHz}$, open drain	-	1.3	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0 \text{ V}$, $V_{DS}=100 \text{ V}$, $f=1 \text{ MHz}$	-	2800	-	pF
Output capacitance	C_{oss}		-	130	-	
Effective output capacitance, energy related ⁵⁾	$C_{o(er)}$	$V_{GS}=0 \text{ V}$, $V_{DS}=0 \text{ V}$ to 480 V	-	130	-	
Effective output capacitance, time related ⁶⁾	$C_{o(tr)}$		-	340	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400 \text{ V}$, $V_{GS}=10 \text{ V}$, $I_D=18 \text{ A}$, $R_G=3.3 \Omega$	-	10	-	ns
Rise time	t_r		-	5	-	
Turn-off delay time	$t_{d(off)}$		-	60	-	
Fall time	t_f		-	5	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD}=400 \text{ V}$, $I_D=18 \text{ A}$, $V_{GS}=0 \text{ to } 10 \text{ V}$	-	14	-	nC
Gate to drain charge	Q_{gd}		-	20	-	
Gate charge total	Q_g		-	60	80	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	

Reverse Diode

Diode forward voltage	V_{SD}	$V_{GS}=0 \text{ V}$, $I_F=18 \text{ A}$, $T_j=25 \text{ }^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time	t_{rr}		-	450	-	
Reverse recovery charge	Q_{rr}		-	12	-	
Peak reverse recovery current	I_{rm}		-	70	-	

¹⁾ J-STD20 and JESD22

²⁾ Pulse width t_p limited by $T_{j,max}$
³⁾ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR} \cdot f$.

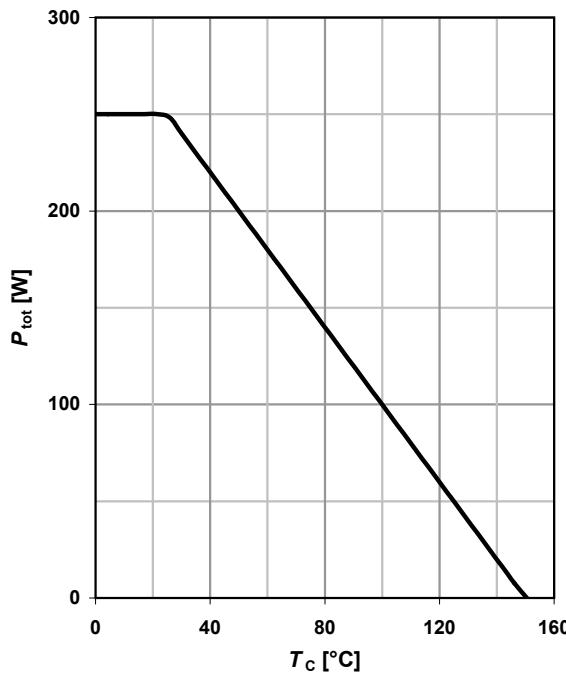
⁴⁾ $I_{SD} \leq I_D$, $di/dt \leq 100 \text{ A}/\mu\text{s}$, $V_{DClink} = 400 \text{ V}$, $V_{peak} \leq V_{(BR)DSS}$, $T_j < T_{j,max}$, identical low side and high side switch

⁵⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

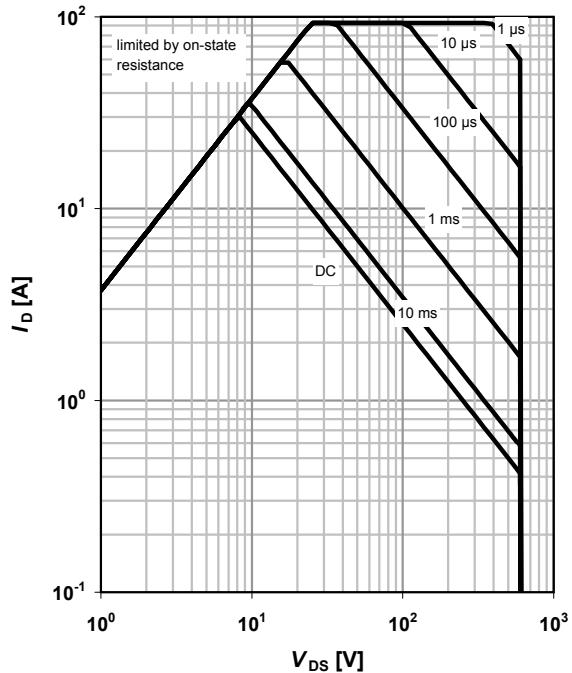
⁶⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

1 Power dissipation

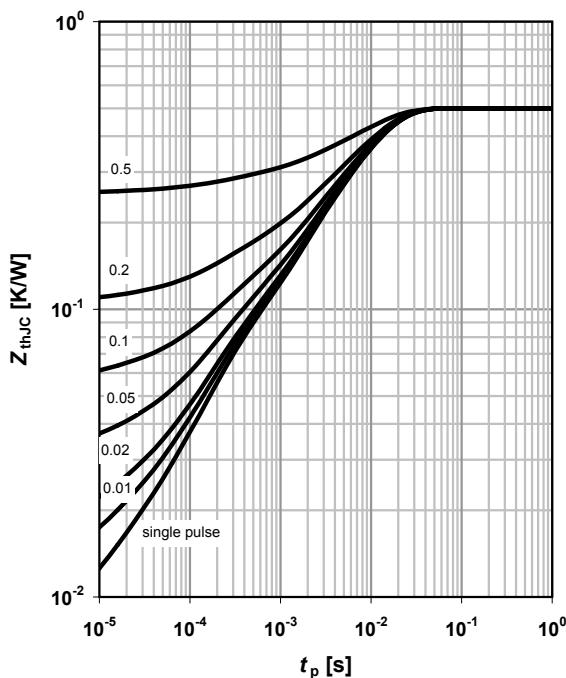
$$P_{\text{tot}} = f(T_c)$$


2 Safe operating area

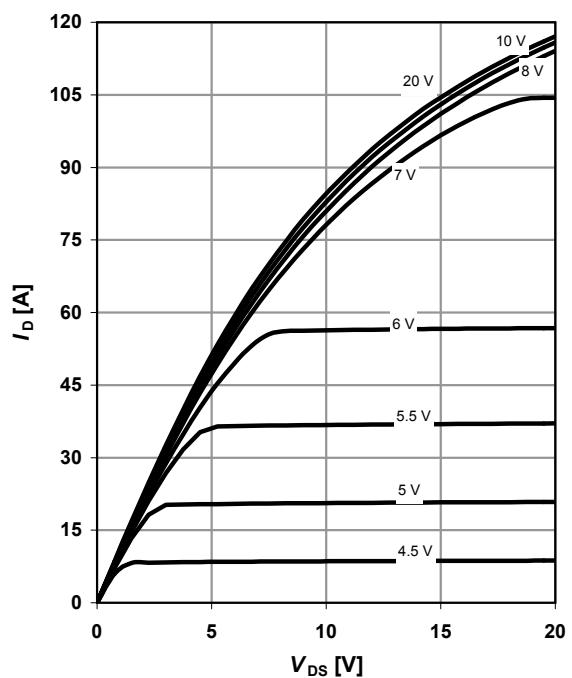
$$I_D = f(V_{\text{DS}}); T_c = 25^\circ\text{C}; D = 0$$

 parameter: t_p

3 Max. transient thermal impedance

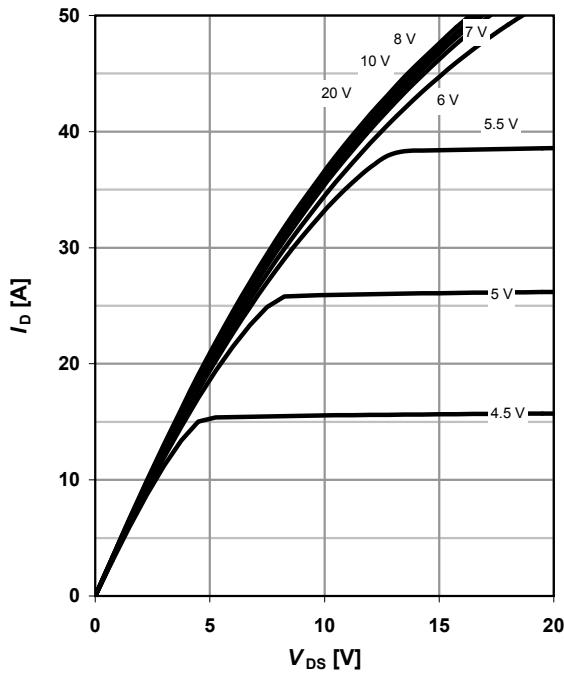
$$Z_{\text{thJC}} = f(t_p)$$

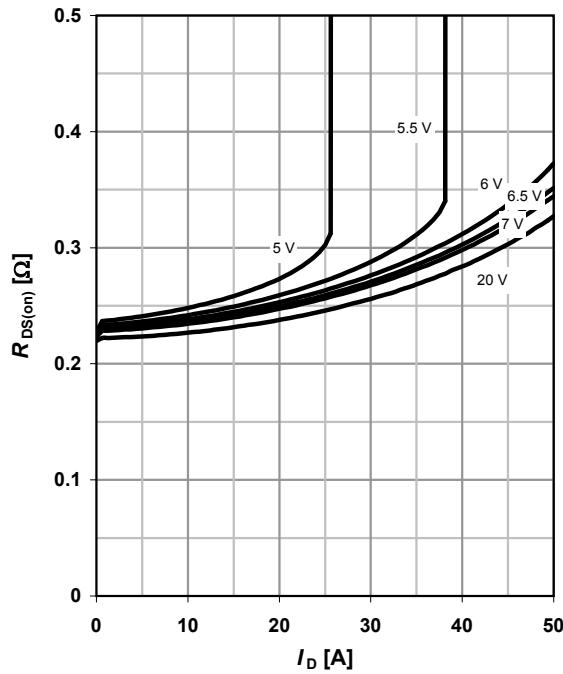
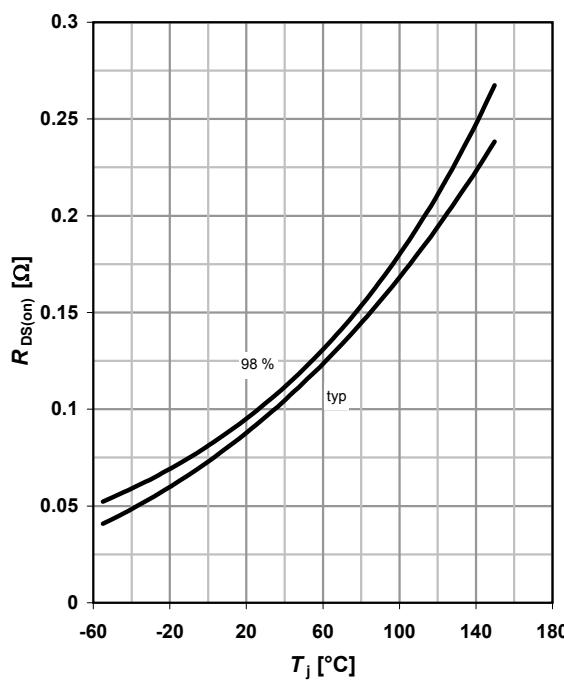
 parameter: $D = t_p/T$

4 Typ. output characteristics

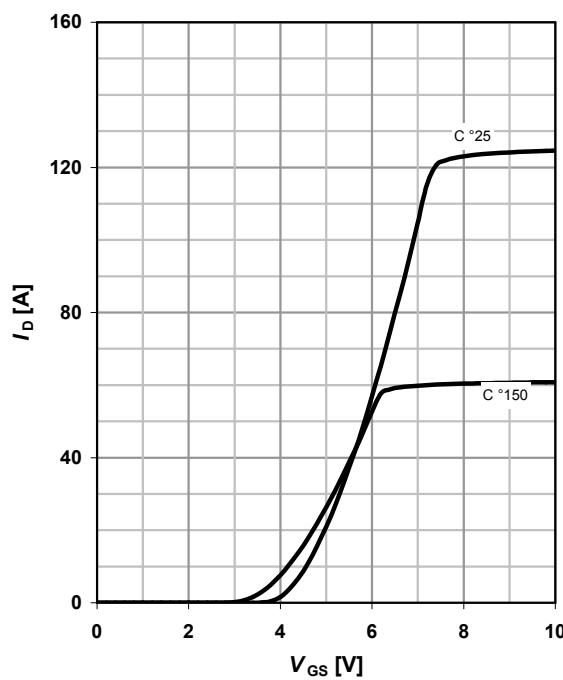
$$I_D = f(V_{\text{DS}}); T_j = 25^\circ\text{C}$$

 parameter: V_{GS}


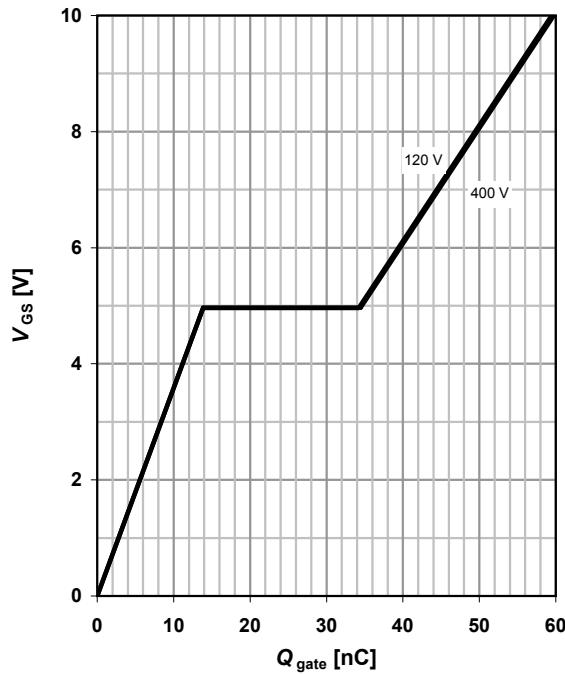
5 Typ. output characteristics
 $I_D = f(V_{DS})$; $T_j = 150 \text{ }^\circ\text{C}$

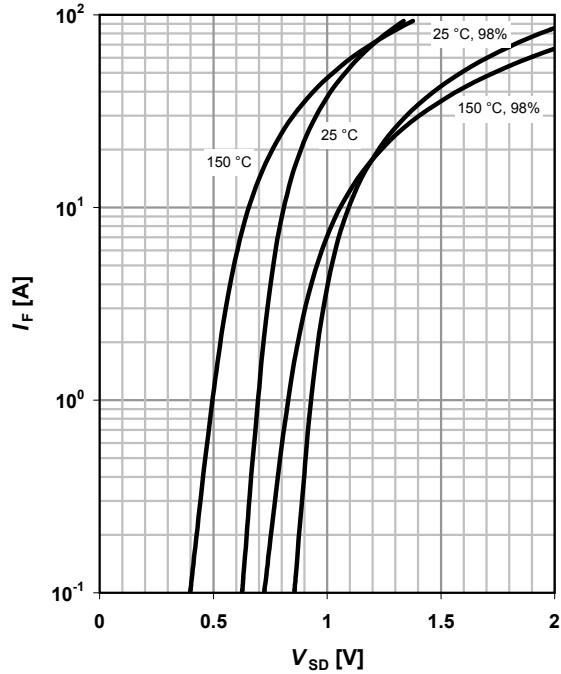
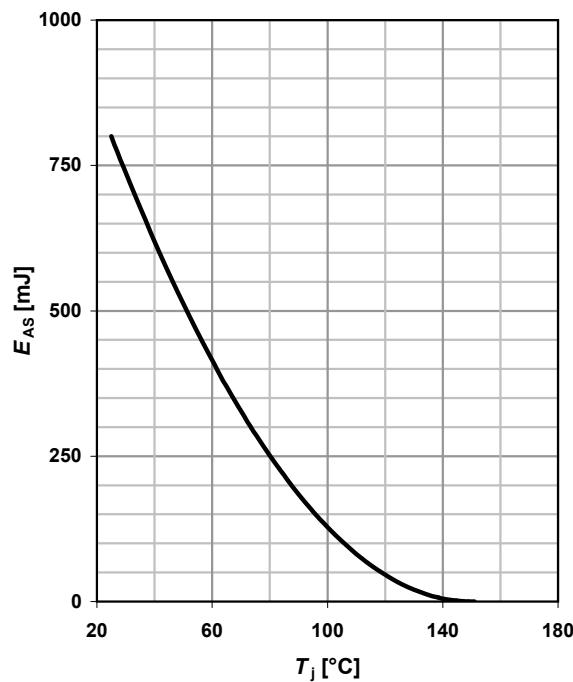
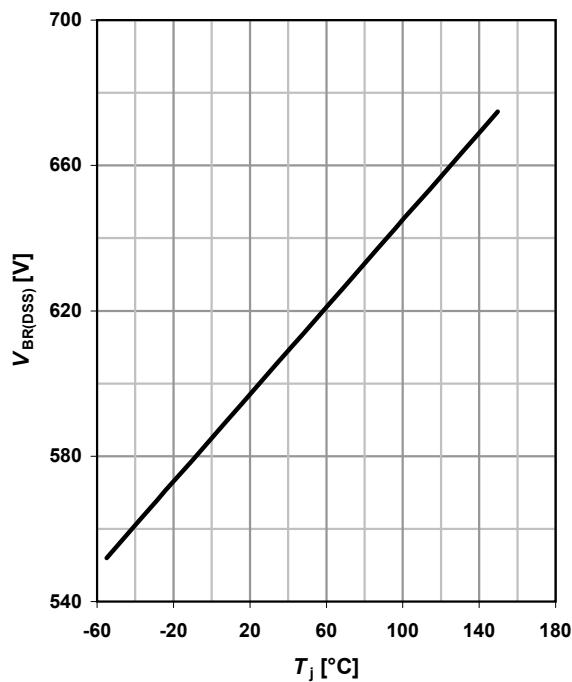
 parameter: V_{GS}

6 Typ. drain-source on-state resistance
 $R_{DS(on)} = f(I_D)$; $T_j = 150 \text{ }^\circ\text{C}$

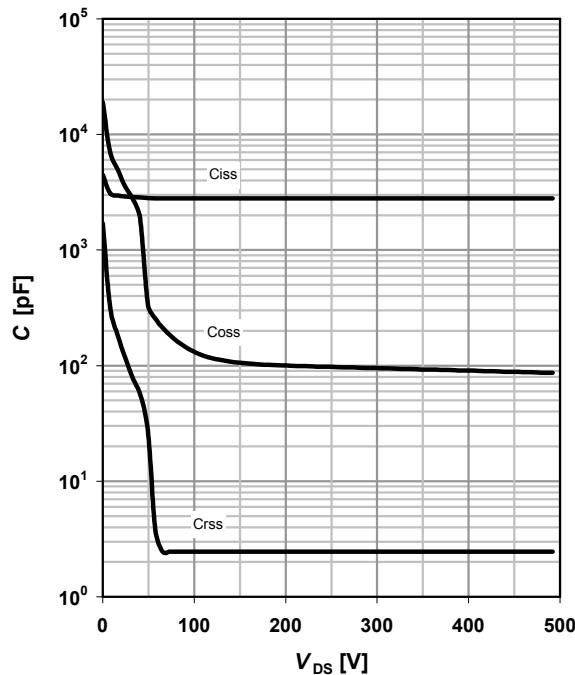
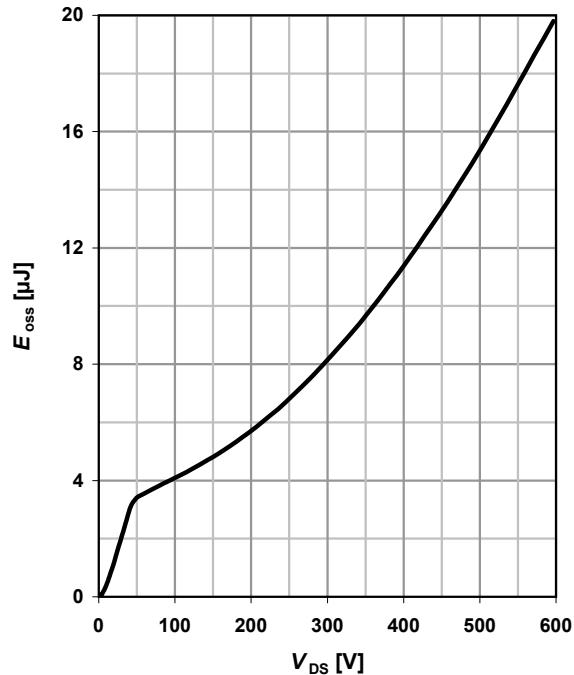
 parameter: V_{GS}

7 Drain-source on-state resistance
 $R_{DS(on)} = f(T_j)$; $I_D = 18 \text{ A}$; $V_{GS} = 10 \text{ V}$

8 Typ. transfer characteristics
 $I_D = f(V_{GS})$; $|V_{DS}| > 2|I_D|R_{DS(on)max}$

 parameter: T_j


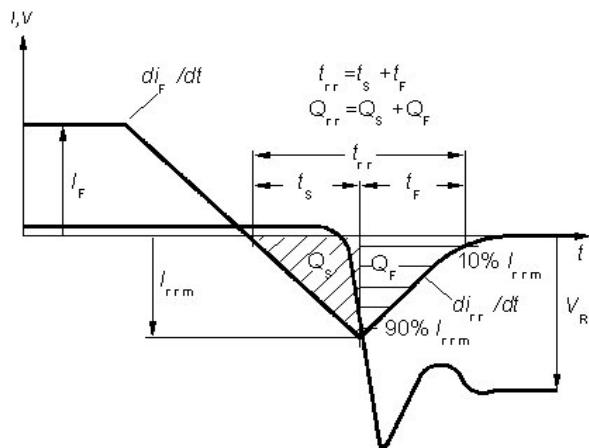
9 Typ. gate charge
 $V_{GS} = f(Q_{gate})$; $I_D = 18 \text{ A}$ pulsed

 parameter: V_{DD}

10 Forward characteristics of reverse diode
 $I_F = f(V_{SD})$

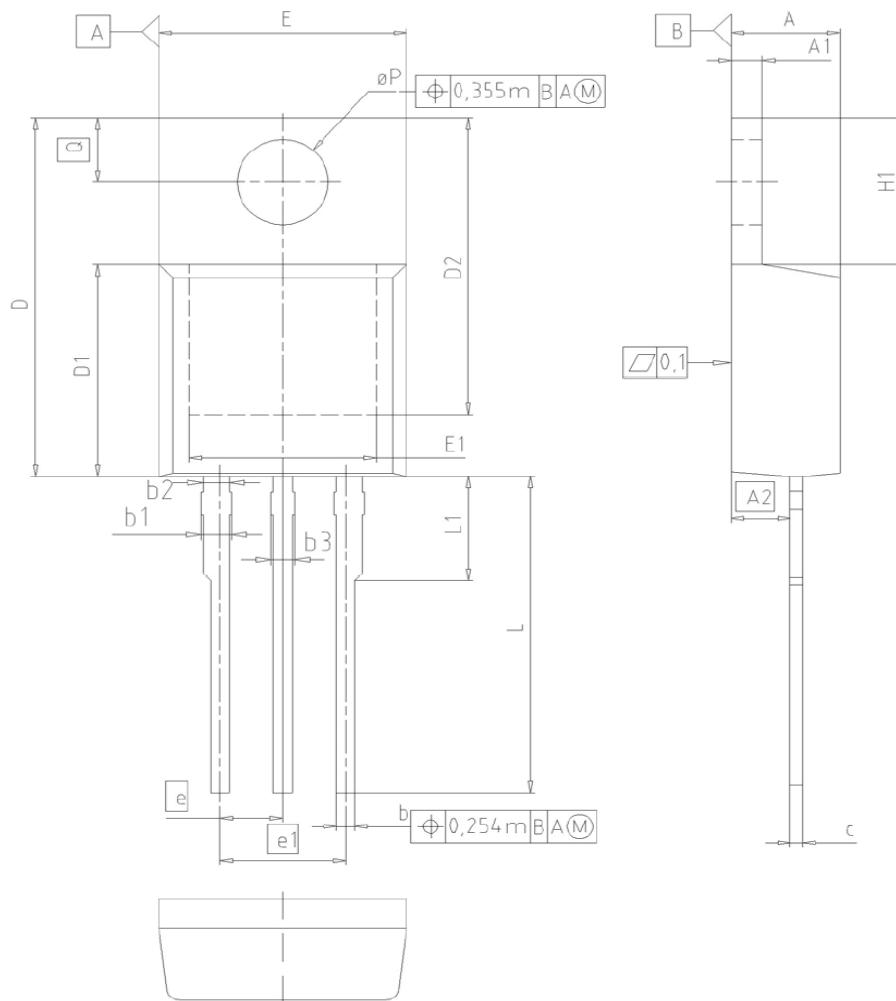
 parameter: T_j

11 Avalanche energy
 $E_{AS} = f(T_j)$; $I_D = 11 \text{ A}$; $V_{DD} = 50 \text{ V}$

12 Drain-source breakdown voltage
 $V_{BR(DSS)} = f(T_j)$; $I_D = 0.25 \text{ mA}$


13 Typ. capacitances
 $C=f(V_{DS})$; $V_{GS}=0$ V; $f=1$ MHz

14 Typ. Coss stored energy
 $E_{oss}=f(V_{DS})$


Definition of diode switching characteristics



PG-TO220-3-1/TO220-3-21: Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	1.17	1.40	0.046	0.055
A2	2.15	2.72	0.085	0.107
b	0.65	0.86	0.026	0.034
b1	0.95	1.40	0.037	0.055
b2	0.95	1.15	0.037	0.045
b3	0.65	1.15	0.026	0.045
c	0.33	0.60	0.013	0.024
D	14.81	15.95	0.583	0.628
D1	8.51	9.45	0.335	0.372
D2	12.19	13.10	0.480	0.516
E	9.70	10.36	0.382	0.408
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	3		3	
H1	5.90	6.90	0.232	0.272
L	13.00	14.00	0.512	0.551
L1	-	4.80	-	0.189
oP	3.60	3.89	0.142	0.153
Q	2.60	3.00	0.102	0.118

DOCUMENT NO.	Z8B00003318
SCALE	0 2.5 0 2.5 5mm
EUROPEAN PROJECTION	
ISSUE DATE	23-08-2007
REVISION	05

Dimensions in mm/inches:

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